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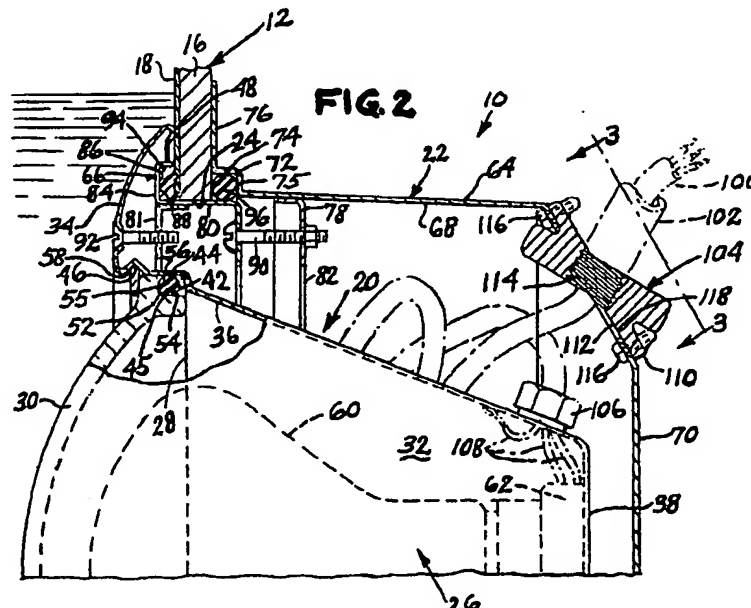
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(54) Aquatic lamp mounting structure.

(57) A light assembly for installation in an aquatic facility such as a swimming pool, fountain or the like. The light assembly (10) has a watertight lamp housing (20) mounted within a generally cup-like mounting box (22) to be installed within a wall recess or opening in the aquatic facility. Both the mounting box and the lamp housing have body shells which are tapered for stacking during manufacture, storage, and installation. The mounting box has a coupling (104) which is adapted for connection to an electrical

conduit (102) containing an electrical cable (100) that conducts electrical power to the lamp housing and which is adjustable to accommodate a range of orientations of the conduit relative to the box. The body of the lamp housing has a unique one piece shell construction (28) including an integrally formed main body portion (32) and face ring (34) which greatly simplifies and reduces the manufacturing cost of the housing.



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BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION This invention relates generally to illumination devices and more particularly to an improved aquatic light assembly for underwater installation in aquatic pools, fountains, and the like.

DISCUSSION OF THE PRIOR ART Most if not all swimming pools and many other aquatic pools, fountains and the like are equipped with underwater lights for providing illumination at night. In the case of swimming pools, the lights serve the dual function of providing the illumination necessary for convenient and safe nighttime use of the pools and providing the pools with a highly ascetic nighttime appearance. The underwater lights of other aquatic pools, fountains, and the like provide only ascetic illumination. All such aquatic lights, however, have certain common structural requirements which result from their underwater installation.

A typical aquatic light assembly has a watertight lamp housing to be installed within an opening or recess in the pool wall below the normal water level in the pool. This lamp housing contains an electrical receptacle for receiving a light bulb or lamp and has a front transparent lens which passes light from the lamp to the exterior of the lamp housing. The lamp housing is mounted within the pool wall recess or opening with the front lens of the housing generally flush with the wall. Many aquatic light installations of this kind also include a shell-like mounting box which is permanently placed within the pool wall opening or recess and is sized and shaped to removably receive the lamp housing. This mounting box has an open front end thru which the light housing is insertable into and removable from the mounting box. The lamp housing is releasibly secured within the mounting box. Electrical power is delivered to the lamp receptacle within lamp housing thru a waterproof electrical cable which extends thru the mounting box and is sealed to the lamp housing. The cable leading to the mounting box is commonly contained within an electrical conduit which is threaded into a coupling on the mounting box. A sufficient length of cable is provided within the mounting box to permit removal of the lamp housing thru the open front end of the mounting box. The prior aquatic lights are designed for installation in both traditional concrete or Gunite pools and vinyl lined steel walled pools.

My prior patent US-A 4,433,366 discloses an underwater aquatic light assembly of the character described. The lamp housing of this prior aquatic light assembly has a body comprising three separately formed parts which are a rear housing shell having a front end opening surrounded by a tapered front flange on the housing shell, a face ring having an inner tapered circumferential flange fac-

ing the front housing shell flange, and a radially contractable coupling ring having an inner tapered groove receiving the housing shell and face ring flanges. The perimeter of the lens fits within a groove in a seal ring which is disposed within the coupling ring between the housing shell and face ring flanges. The coupling ring is radially contracted to firmly join the housing shell, face ring, and lens into a rigid unit and seal these parts to one another to form a watertight lamp housing.

The aquatic light assembly of my prior patent also includes a mounting box for permanent installation within an opening or recess in an aquatic pool wall. The watertight lamp housing is removably secured within this mounting box with the face ring of the lamp housing projecting radially out from the housing for seating contact with the front end of the mounting box or with the pool wall.

SUMMARY OF THE INVENTION

This invention provides an improved aquatic aquatic light assembly of the general class described. According to one of its aspects, the invention provides a novel one piece unitary body for the watertight lamp housing of the aquatic light assembly. This housing body comprises a one piece shell including a rear cup-like portion and a front face ring integrally joined to the front end of the rear shell portion. The rear portion of the body shell forms the main body of the lamp housing and mounts a receptacle for receiving the lamp of the aquatic light assembly. The front face ring has a rearwardly facing, circumferential seating surface. The body shell has a front end opening spanned by a transparent lens. The lens is releasibly secured to the lamp housing and is sealed to the housing by a seal ring disposed between the perimeter of the lens and sealing surfaces on the shell.

In the preferred embodiments of the invention, the rear body portion of the lamp housing shell is tapered to permit compact stacking of a number of the housings during fabrication, storage, and installation of the aquatic light assemblies. The front end of the housing shell is radially outwardly stepped or offset to form a forwardly and inwardly opening recess which receives the perimeter of the lens and forms with the lens perimeter an annular cavity containing the seal ring for sealing the lens to the shell. Forwardly of this lens recess is a second recess receiving a lock ring for securing the lens to the housing shell with the lens sealed to the housing to provide with the shell a watertight lamp housing.

According to another aspect of the invention, the aquatic light assembly includes an improved mounting box for the lamp housing. This mounting

box comprises a shell open at its front end and mounting a novel adjustable rear coupling for engagement with the electrical conduit which contains the electrical cable for conducting electrical power to the aquatic light assembly. This coupling is uniquely shaped and arranged for adjustable attachment to the mounting box in a manner which permits adjustment of the coupling relative to the mounting box to accommodate a range of orientations of the conduit relative to the mounting box.

The mounting box is permanently installed in the wall of a pool with the open front end of the mounting box opening to the pool. The pool may be either a traditional concrete or Gunitite pool, in which case the mounting box is installed within a recess in the pool wall, or a vinyl covered rigid-walled pool, in which case the mounting box is installed within an opening in the wall. The improved lamp housing of the invention is inserted into this mounting box thru its open front end to a position where the rear seating surface of the lamp housing face ring seats either directly against the pool wall or against the front end of the mounting box.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a fragmentary perspective view of a vinyl-lined steel walled aquatic pool containing an improved aquatic light assembly according to the invention;

Figure 2 is an enlarged section through the aquatic light assembly taken in a longitudinal plane of the light;

Figure 3 is a View taken on line 3-3 in figure 2 and illustrating the rear conduit coupling of the aquatic light assembly mounting box in one position of adjustment;

Figure 4 is a view similar to figure 3 illustrating the coupling in another position of adjustment;

Figure 5 is an enlarged section taken on line 5-5 in figure 4;

Figure 6 is a section through a modified aquatic light assembly according to the invention installed in a traditional concrete or Gunitite pool;

Figure 7 illustrates the manner in which a number of the improved aquatic light assembly mounting boxes of the invention may be stacked; and

Figure 8 is a fragmentary view of the rear portion of the mounting box of Figure 6, showing openings to accommodate the rear conduit coupling and fasteners for securing the same.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to these drawings and first to

figures 1-5, there is illustrated an improved aquatic aquatic light assembly 10 according to the invention installed in the wall 12 of a swimming pool 14. The particular pool wall shown is a vinyl-covered wall including a steel wall member 16 covered with a vinyl layer 18. The improved aquatic light assembly 10 includes a watertight lamp housing 20 removably mounted within a mounting box 22 to be permanently installed within an opening 24 in the pool wall 12.

The improved lamp housing 20 of the aquatic light assembly 10 comprises a novel one-piece body 26 in the form of a shell with a front end opening 28, and a transparent lens 30 spanning the opening 28. The lens is secured and sealed to the housing shell 26 to form with the shell a watertight lamp housing. The housing shell 26 includes a rear, generally cup-like portion 32 and a front face ring 34. The rear shell portion 32 has a circumferential side wall 36 with front and rear ends and a rear wall 38 integrally joined about its perimeter to the rear end of the side wall to close the rear end of the housing shell. The front end of the housing shell 32 is radially outwardly offset or stepped to form a forwardly and inwardly opening seal ring recess 42 circumferentially surrounding the front housing opening 28. The walls of this recess provide sealing surfaces 44. Forwardly of the recess 42 is a lock ring recess 46.

The housing shell face ring 34 is coaxial with the rear shell portion 32 and is integrally joined to the front end of the shell side wall 36 forwardly of the seal ring and lock ring recesses 42, 46. The face ring extends laterally outward from the housing shell side wall and curves rearwardly in longitudinal cross-section, as shown in figure 2. The outer perimeter of the face ring is turned radially inward, also as also shown in figure 2, to form a rear, rearwardly facing seating surface 48 about the ring perimeter.

The unitary one piece lamp housing body or shell 26 including its rear body portion 32 and front face ring 34 may be fabricated in any convenient way from sheet metal or plastic and constitutes an important feature of the invention which greatly simplifies and reduces the fabrication cost of the aquatic light assembly.

The perimeter of the lens 30 engages within the housing shell seal ring recess 42. Formed in the lens perimeter is an outwardly and rearwardly opening circumferential seal ring recess 52 bounded by sealing surfaces 54. These lens sealing surfaces 54 form with the shell sealing surfaces 44 an annular cavity 54 containing a captivated seal ring 56. The lens 30 is releasably secured to the lamp housing 26 by a snap lock ring 58 engaged within the lock ring recess 46. The seal ring 56 is compressed between the sealing surfaces 44, 54 to

form a watertight seal between the housing shell 26 and the lens 30 and thereby provide a watertight lamp housing or enclosure 20 for containing a lamp 60. Mounted on the rear wall 38 of the lamp housing 26 is an electrical receptacle 62 for receiving the base of the lamp 60.

The mounting box 22 of the aquatic light assembly 10 includes a rear, generally cup-like cylindrical shell 64 and a front clamp ring 66. The rear shell 64 has a tapered side wall 68 and a rear wall 70. The front end of the shell side wall 68 is radially outwardly stepped and turned to form about the open front end of the shell 64 a forwardly and inwardly opening seal ring recess 72 hounded by sealing surfaces 74 and a front annular flange 76 disposed in a transverse plane of the shell. Rigidly fixed within the shell 64 adjacent its open front end is an annular flange 78. The mounting box shell wall is tapered, as shown, to permit a number of the lamp housings to be stacked in the manner shown in figure 7 during fabrication, storage, and installation of the aquatic light assemblies.

The clamp ring 66 of the mounting box 22 includes a central cylindrical portion 80, front and rear radially inwardly projecting annular flanges 81, 82, and a front radially outwardly and rearwardly projecting flange 84. The outer diameter of the central clamp ring portion 80 approximates or is slightly less than the inner diameter of the box shell side wall 68. The front clamp ring flange 84 forms a seal ring recess 86 bounded by sealing surfaces 88. The clamp ring 66 is secured to the mounting box shell 64 by screws 90 (figure 2).

The lamp housing 20 is coaxially disposed within the mounting box 22 with the front end of the housing projecting forwardly thru the open front end of the box. The housing face ring 34 extends radially outward across the front end of the box to a position where the face ring seating surface 48 is situated radially outward of the front flange 84 of the box clamp ring 66. The lamp housing 20 is secured to the mounting box 22 by screws 92 (figure 2) which extend thru the housing face ring 34 and the flange 81 within the front end of the box clamp ring 66. The mounting box recesses 72, 86 contain seal rings 94, 96.

As noted earlier and shown in figure 2, the aquatic light assembly 10 is mounted within an opening 24 in the pool wall 12. In this case, the pool wall comprises a rigid wall member 16 covered with a vinyl liner 18. The light assembly is installed in the opening in the following manner. The lamp housing 20 is removed from the mounting box 22 by removing the light housing mounting screws 92. The mounting box clamp ring 66 is separated from the mounting box shell 64 by removing the clamp ring screws 90. The shell 64 is placed outside of the pool wall 12 with the shell

flange 76 and seal ring 96 seating against the outer wall surface about the wall opening 24. The mounting box clamp ring 66 is inserted thru the wall opening 24 from the inner side of the pool wall 12 to engage the clamp ring seal ring 94 with the inner wall side and locate the central lock ring portion 80 within the opening. The opening is sized to receive the central clamp ring portion 80 with a close fit. The mounting box shell 64 and clamp ring 66 are rejoined by the screws 90 which are then tightened to draw the shell flange 76 and outer clamp ring flange 84 toward one another until the pool wall 12 is firmly gripped between these flanges to rigidly secure the mounting box 22 to the wall and the box seal rings 94, 96 are compressed against the wall to seal the mounting box to the wall about the wall opening 24.

After this installation of the mounting box 22 in the pool wall opening 24, the lamp housing 20 is inserted into the box thru its open front end. The lamp housing is then rejoined to the mounting box by the screws 92 which are tightened to press the rear seating surface 48 on the housing face ring 34 firmly against the inner surface of the pool wall 12.

Electrical power is fed to the lamp housing 20 thru an electrical cable 100. This cable extends to the lamp housing mounting box 22 thru a tubular electrical conduit 102. The mounting box end of this conduit is threaded in a coupling 104 secured to rear end of the mounting box shell 64. As will be described presently, this coupling is uniquely constructed in accordance with this invention for adjustment to accommodate a range of orientations of the conduit 102 relative to the mounting box. The cable 100 extends from the conduit 102, thru the mounting box 22, to a coupling 106 secured to the lamp housing shell which provides a watertight seal between the cable and the shell. The electrical leads 108 of the cable connect to the terminals of the lamp receptacle 62 within the lamp housing 20. A sufficient slack length of the cable 100 is provided within the mounting box 22 to permit removal of the lamp housing 20 from the box for connection and disconnection of the cable to and from the lamp housing.

As mentioned above, another important aspect of the invention is concerned with the coupling 104 for connecting the cable conduit 102 to the mounting box 22. As shown best in figures 2-5, this coupling includes a mounting flange 110 having at one side a mounting surface 112, and a threaded bore 114 extending thru the flange at an oblique angle to the mounting surface for threadedly receiving the conduit 102. The mounting flange 110 is secured to the rear end of the mounting box shell 64 by bolts 116. As depicted in figures 2-5, the bolts 116 are spaced about the coupling flange 110 in such a way that the coupling 104 may b

secured to the mounting box shell in different angular positions, thereby to effectively angularly adjust the axis of the coupling bore 114 to accommodate different orientations of the cable conduit 102 relative to the mounting box 22. In the particular embodiment illustrated, for example, the coupling 104 is secured to an oblique surface 118 of the box shell 64 and is adjustable to accommodate an inclined conduit 102 in figures 2 and 3 and a generally horizontal conduit in figures 4 and 5.

The modified aquatic light assembly 10a of figure 7 is designed for installation in a wall recess 24a of a concrete or Gunite pool. This modified light assembly is identical to that of figures 1-5 except as follows. The mounting box seal rings 94, 96 in figures 1-5 are omitted in figure 6. The mounting box 22 is disposed with the front flange 66 of the box shell 64 in contact with the outer side of the inner pool wall layer 18a and with the clamp ring flange 84 in contact with the inner side of the wall layer 18a so that the wall layer is gripped between the flanges. The outer projecting portion of the mounting box shell 64 is encased in the outer concrete of the pool wall 12a. The lamp housing face ring 34 seats against the inner side of the inner wall layer 18a.

Thus there has been shown and described a novel aquatic lamp mounting structure which fulfills all the objects and advantages sought therefor. Many changes, modifications, variations and other uses and applications of the subject invention will, however, become apparent to those skilled in the art after considering this specification together with the accompanying drawings and claims. All such changes, modifications, variations and other uses and applications which do not depart from the spirit and scope of the invention are deemed to be covered by the invention which is limited only by the claims which follow.

Claims

1. A lamp housing body for a watertight aquatic light, comprising:

a unitary one piece shell having a front end opening for containing a transparent lens and including a circumferential side wall having a front end surrounding said front end opening and an opposite rear end, a rear end wall integrally joined to the rear end of said side wall, and a face ring about and integrally joined to the front end of said side wall, and wherein

said front end of said shell side wall has an inner recess surrounding said front end opening for receiving the perimeter of a lens positioned in said opening and a seal ring for

sealing the lens to said shell, and said face ring projects radially out from said side wall and has a rear seating surface about its perimeter.

2. A lamp housing body according to claim 1 wherein:

said shell is tapered for stacking.

3. A lamp housing body according to claim 1 wherein:

said front end of said shell side wall contains a circumferential lock-ring-receiving recess forwardly of said first mentioned recess.

4. A lamp housing body according to claim 1 wherein:

said front end of said shell side wall has a circumferential portion which is offset radially outwardly to form a forwardly and inwardly opening recess which constitutes said first mentioned recess, and an inner circumferential recess forwardly of said seal ring recess for receiving a lock ring, and

said shell face ring is joined to said side shell side wall forwardly of said lock ring recess.

5. A lamp housing body according to claim 4 wherein:

said shell is tapered for stacking.

6. A watertight aquatic lamp housing comprising:

a lamp housing body comprising a generally cup-like shell having an open front end containing a front end opening and a closed rear end and including a circumferential side wall having a front end surrounding said front end opening and an opposite rear end at said rear shell end, a rear end wall integrally joined to the rear end of said side wall, and a face ring about and integrally joined to the front end of said side wall,

an electrical receptacle mounted within said shell on said shell rear end wall for receiving a light bulb,

a transparent lens positioned within said shell front end opening,

means securing said lens to said shell, and

means sealing said lens to said shell.

7. A lamp housing according to claim 6 wherein:

said shell is tapered for stacking.

8. A lamp housing according to claim 6 wherein:

said front end of said shell side wall has a circumferential portion which is offset radially outwardly to form a first forwardly and inwardly opening recess about said front end opening bounded by forwardly and radially inwardly facing wall surfaces and receiving the perimeter of said lens, and a second inner circumferential lock-ring-receiving recess about said front end opening forwardly of said first recess,

said shell face ring is joined to said side shell side wall forwardly of said lock ring recess,

said sealing means comprises a seal ring within said first recess between said lens perimeter and said first recess surfaces, and

said securing means comprises a lock ring positioned in said lock ring recess and seating against the front side of said lens.

9. A lamp housing according to claim 8 wherein:

said shell is tapered for stacking.

10. An aquatic light assembly comprising:

a mounting box comprising a cup-like shell having an open front end,

a watertight lamp housing within said mounting box comprising a generally cup-like shell having an open front end containing a front end opening and a closed rear end and including a circumferential side wall having a front end surrounding said said housing front end opening and an opposite rear end, a rear end wall integrally joined to the rear end of said side wall, and a face ring about and integrally joined to the front end of said side wall and projecting radially outward from said side wall forwardly of and across the front end of said mounting box, an electrical receptacle mounted within said housing shell on said housing shell rear end wall for receiving a light bulb, a transparent lens positioned within said housing shell front end opening, means securing said lens to said housing shell, and means sealing said lens to said housing shell, and

means releasibly joining said lamp housing and mounting box.

11. A light assembly according to claim 10 wherein:

said mounting box shell is tapered for stacking.

12. A light assembly according to claim 10 wherein:

both said mounting box shell and said housing shell are tapered for stacking.

13. A light assembly according to claim 10 wherein:

said mounting box shell has an outer circumferential flange about and projecting radially outward from the open front end of said mounting box shell, and an inner circumferential flange, and

said means releasibly joining said lamp housing and mounting box comprise screws extending thru said lamp housing face ring and said inner mounting box flange for drawing said outer mounting box flange and said face ring toward one another.

14. A light assembly according to claim 10 wherein:

said mounting box further comprises a seal ring about the open front end of said mounting box shell, a clamp ring coaxially disposed opposite the open front end of said mounting box shell including a seal ring, and means joining said mounting box shell and clamp ring for moving said box shell and clamp ring and thereby their seal rings toward one another.

15. A light assembly according to claim 14 wherein:

said mounting box shell includes a circumferential side wall having a radially offset front end portion forming a forwardly and inwardly opening circumferential recess about the open front end of the box shell receiving the seal ring on said mounting box shell, and an inner circumferential flange within said mounting box shell rearwardly of said side box shell recess,

said mounting box clamp ring includes a central cylindrical portion coaxially disposed within the open front end of said mounting box shell, an outer circumferential flange about said

clamp ring central portion forming a rearwardly opening recess receiving said clamp ring seal ring, and inner circumferential flange means about the inside of said clamp ring central portion,

said means joining said mounting box clamp ring and shell comprise screws extending thru said inner clamp ring flange means and said inner mounting box flange, and

said means releasibly joining said lamp housing and mounting box comprise screws extending thru said lamp housing face ring and said inner clamp ring flange means for drawing said outer mounting box flange and said face ring toward one another.

16. A light assembly according to claim 10 wherein:

said mounting box includes a rear coupling having a threaded bore to receive a threaded end of an electrical conduit containing an electrical cable for conducting electrical power to said lamp housing receptacle, and said coupling is adjustable to vary the angle of the axis of said threaded bore relative to said mounting box shell.

17. A light assembly according to claim 16 wherein:

said mounting box shell has a rear mounting surface for said coupling containing a cable opening thru which may pass an electrical cable extending thru a conduit threaded in said coupling bore,

said coupling has a mounting surface thru which one end of said coupling bore opens and which is disposed at an oblique angle relative to said axis of said coupling bore,

said coupling is disposed with its coupling surface in contact with said mounting surface and with said one end of said coupling bore aligned with said cable opening, and the coupling is rotatable about the axis of said cable opening to vary the angle of said coupling bore relative to said mounting box, and

means for releasibly securing said coupling to said mounting surface in different angular positions about the axis of said cable opening.

18. A mounting box for an aquatic light comprising:

a generally cup-like shell having an open front end for receiving an aquatic light, and a rear coupling on said shell having a threaded bore to receive a threaded end of an electrical conduit containing an electrical cable for conducting electrical power to said light, and wherein

said coupling is adjustable to vary the angle of the axis of said threaded bore relative to said shell.

19. A mounting box according to claim 18 wherein:

said shell has a rear mounting surface for said coupling containing a cable opening thru which may pass an electrical cable extending thru a conduit threaded in said coupling bore,

said coupling has a mounting surface thru which one end of said coupling bore opens and which is disposed at an oblique angle relative to said axis of said coupling bore,

said coupling is disposed with its coupling surface in contact with said mounting surface and with said one end of said coupling bore aligned with said cable opening, and the coupling is rotatable about the axis of said cable opening to vary the angle of said coupling bore relative to said mounting box, and

means for releasibly securing said coupling to said mounting surface in different angular positions about the axis of said cable opening.

20. An electrical conduit coupling comprising:

a coupling part including a threaded bore extending thru the part for receiving a threaded end on an electrical cable conduit, and a mounting flange including a mounting surface thru which one end of said bore opens and containing holes to receive screws for securing said coupling part to a supporting member, and wherein

said mounting surface is disposed at an oblique angle to the axis of said bore.

21. A mounting box for an aquatic light comprising:

a generally cup-like shell having a front end opening and including a circumferential side wall, a radially outwardly projecting flange about said opening, and a radially outwardly stepped portion between and integrally joined

to said side wall and said flange and forming a forwardly and inwardly opening recess about said opening, and wherein

said shell is tapered for stacking.

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22. A mounting box according to claim 21 including:

a seal ring within said recess, a clamp ring coaxially disposed at the front end of said shell having a coaxial rearwardly opening recess, a seal ring within said rearwardly opening recess, and means joining said shell and clamp ring for moving said shell and ring and thereby their seal rings toward one another.

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FIG. 1

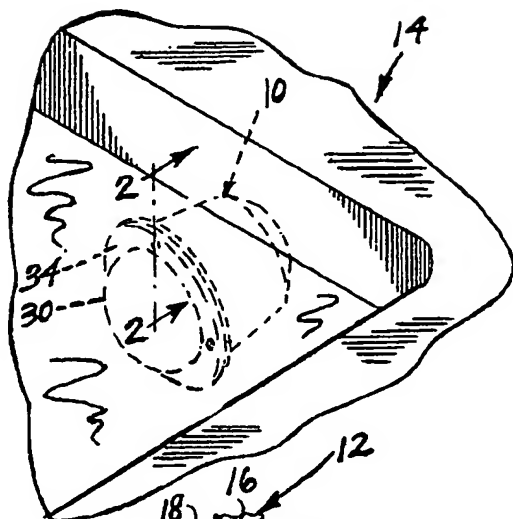


FIG. 5

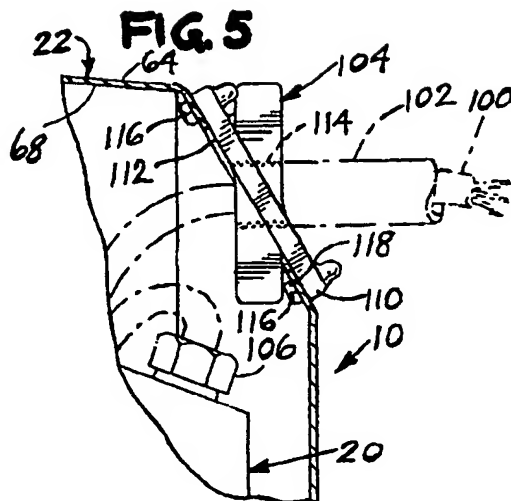


FIG. 2

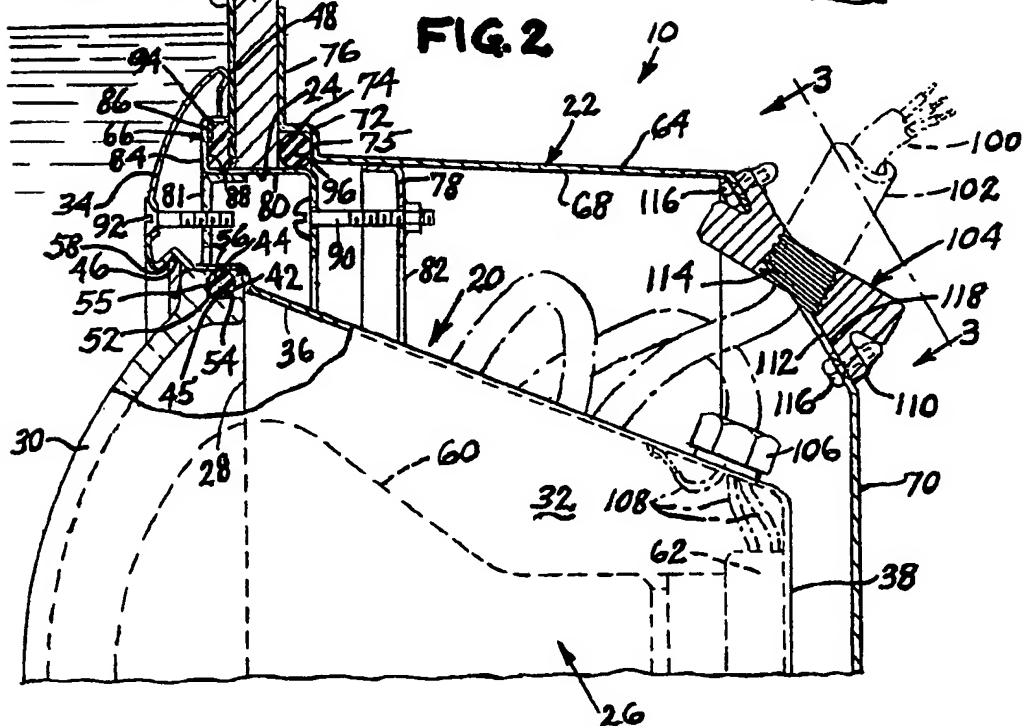


FIG. 3

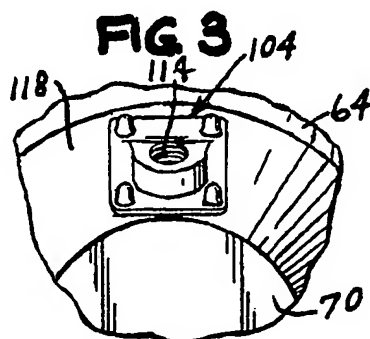
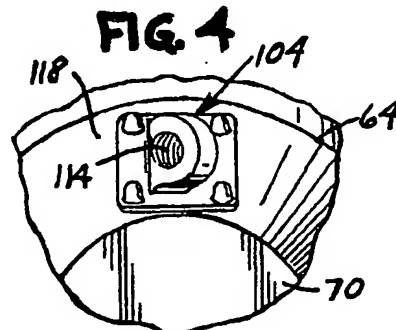


FIG. 4



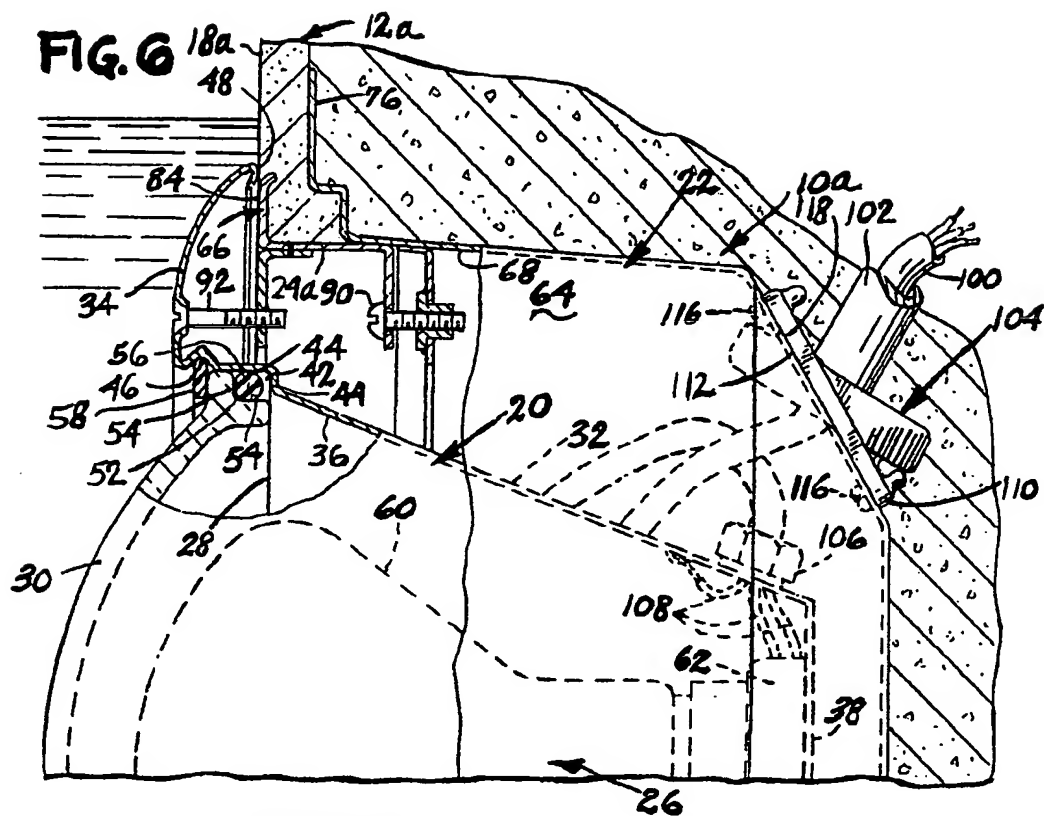


FIG. 7

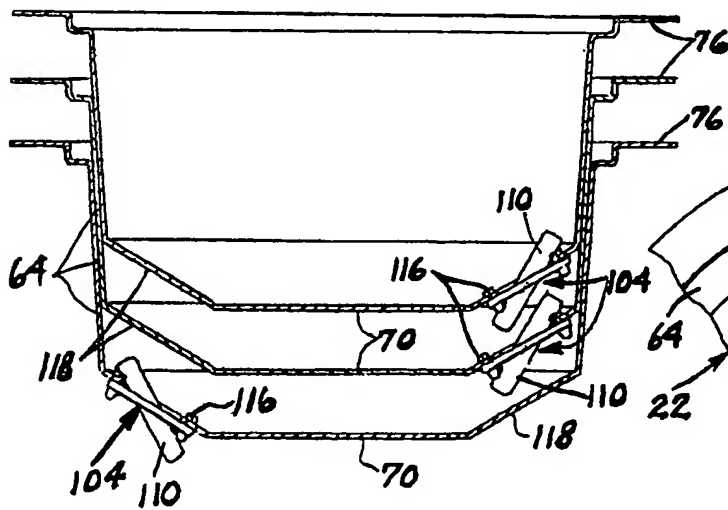
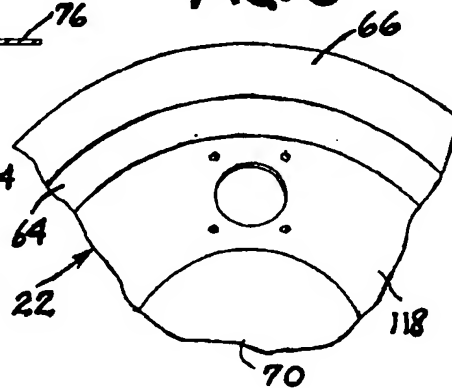


FIG. 8





European
Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 11 0845

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	DE-A-3 635 808 (SCHYDLO) * Column 4, line 42 - column 5, line 31; fig. * - - -	6	F 21 P 7/00 F 21 V 31/00
Y,D	US-A-4 433 366 (WADE) * Abstract; column 3, lines 35-45; figures 2,3 *	18-20	
A,D	- - -	1,6,10,21	
Y	DE-A-2 723 986 (KRONE GmbH) * Claims 1,2; figures 1-5 *	18-20	
A	- - -	16,17	
A	US-A-3 949 213 (PAITCHELL) * Column 2, line 34 - column 3, line 23; figure 1 * - - -	6,7,10,16, 18-20	
A	EP-A-0 188 366 (NOVETTA LTD) * Page 3, line 17 - page 4, line 33; figures 1,2 * - - - - -	6	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F 21 P F 21 V H 02 G
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of search 22 January 91	Examiner MARTIN C.P.A.
CATEGORY OF CITED DOCUMENTS X: particularly relevant if taken alone Y: particularly relevant if combined with another document of the same category A: technological background O: non-written disclosure P: intermediate document T: theory or principle underlying the invention E: earlier patent document, but published on, or after the filing date D: document cited in the application L: document cited for other reasons &: member of the same patent family, corresponding document			